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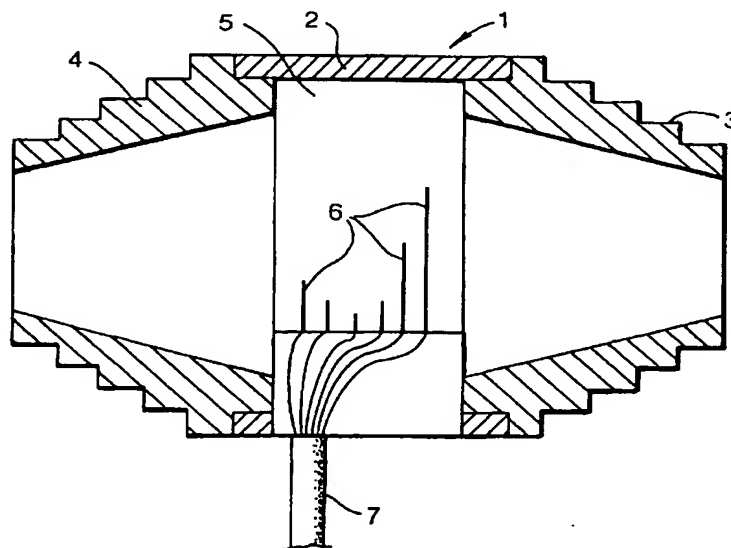
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- (71) Applicant (*for all designated States except US*): **QINETIQ LIMITED** [GB/GB]; Registered Office_85, Buckingham Gate, London SW1E 6PD (GB).
- (72) Inventor; and
- (75) Inventor/Applicant (*for US only*): **COLLINS, Paul, Antony** [GB/GB]; Oakwood, Gwystre, Llandrindod Wells, Powys LD1 6RN (GB).
- (74) Agent: **OBEE, Robert, William**; IP QinetiQ Formalities, Cody Technology Park, A4 Building, Ively Road, Farnborough, Hampshire GU14 0LX (GB).
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(54) Title: **AIR/FUEL CONDITIONING**



(57) Abstract: An apparatus for conditioning air and fuel supplied to a combustor (e.g. internal combustion engine) generates ions of opposite polarities in the air and fuel prior to mixing. The apparatus provides respective chambers (such as 5) through which the air and fuel flows, into which needle-like electrodes (such as 6) extend. The electrodes are connected to low-current high voltage power supplies of respective polarity to generate ions in the respective fluids by corona discharge. This promotes atomisation and dispersal of the fuel into finer droplets within the combustor and more rapid and complete intermixing with the air.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Air/Fuel Conditioning

The present invention relates to an apparatus and method for conditioning air and fuel supplied to combustors and more particularly (though not exclusively) is
5 concerned with the conditioning of air and petrol or diesel fuels supplied to internal combustion engines.

Various systems have been proposed which purport to improve the performance of and/or reduce emissions from internal combustion engines by electrically charging or
10 ionising the supplied air and/or fuel, as known e.g. from US4071004, US4183337, US4308844, US5010869 and US6463917. The present invention seeks to provide an apparatus and method whereby such aims may be more readily achieved.

In one aspect the invention accordingly resides in apparatus for conditioning air and
15 fuel supplied to a combustor, comprising:

- a first chamber through which, in use, air flows to a combustor;
- a second chamber through which, in use, fuel flows to a combustor;
- first electrode means extending into the first chamber;
- second electrode means extending into the second chamber; and
- 20 one or more electric power supplies adapted to be connected to said electrode means whereby to generate ions of a first polarity in air flowing through the first chamber and to generate ions of opposite polarity to said first polarity in fuel flowing through the second chamber.

25 Preferably the apparatus is adapted to generate ions of negative polarity in air flowing through the first chamber and to generate ions of positive polarity in fuel flowing through the second chamber.

The first and second electrode means preferably comprise respective needles, pins
30 or the like pointed members.

The invention also resides in a combustor equipped with air and fuel conditioning apparatus as defined above.

35 The invention also resides in a method of conditioning air and fuel supplied to a combustor, comprising:

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causing air to flow through a first chamber into which first electrode means extend;

causing fuel to flow through a second chamber into which second electrode means extend; and

- 5 applying electrical power to said electrode means whereby to generate ions of a first polarity in air flowing through the first chamber and to generate ions of opposite polarity to said first polarity in fuel flowing through the second chamber.

10 These and other features of the present invention will now be more particularly described, by way of example, with reference to the accompanying schematic drawings, in which:

Figure 1 is a section through the air ionising unit in one embodiment of apparatus according to the invention; and

15

Figure 2 is a section through the fuel ionising unit of the apparatus.

The drawings illustrate examples of air and fuel ionising units which may typically be used in conjunction with a diesel or other internal combustion engine.

20

The unit 1 illustrated in Figure 1 is intended to be inserted in the air induction system of the engine. It comprises a generally tubular housing 2 of electrically insulative material fitted with inlet and outlet connectors 3 and 4 of stepped external diameters which can be cut to fit a range of air hose diameters as required. The interior of the housing 2 defines a chamber 5 through which filtered air passes on its way to the engine's combustion chambers. A plurality of needle-like metal electrodes 6 extend into this chamber and are connected by a cable 7 to an ion generator power supply (not shown). The latter applies a low-current high DC or pulsed voltage (typically 3 to 1,000 kV) of negative polarity to the base of each electrode 6. The consequent surface electric field concentrated at the tip of each electrode results in corona discharges and the generation of negatively charged particles (ions) in the air.

35 The unit 8 illustrated in Figure 2 is intended to be inserted in the fuel line to the engine, preferably downstream of the fuel pump. It comprises a main housing 9 and cover 10 of electrically insulative material. The housing 9 has inlet and outlet connectors 11 and 12, and defines a passageway 13 leading to a chamber 14 through which fuel passes on its way to the engine's fuel injectors. The cover 10

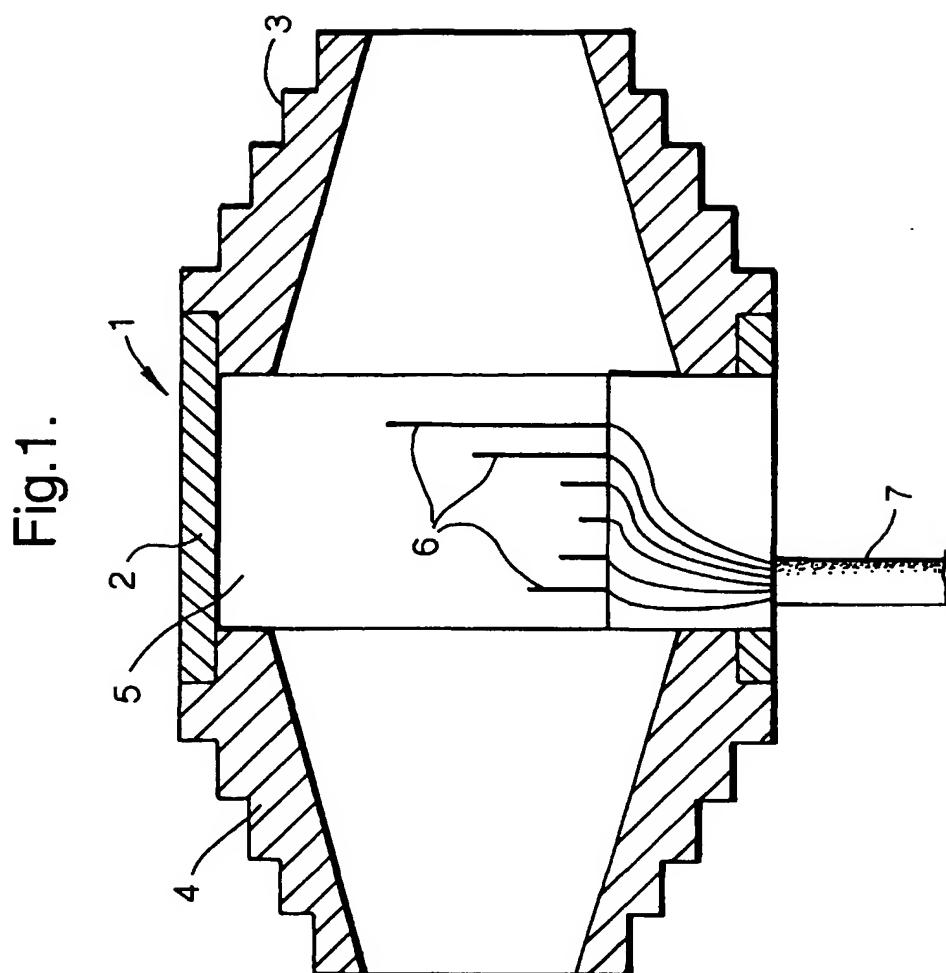
carries a plurality of needle-like metal electrodes 15 extending into the chamber 14 and connected by a cable 16 to an ion generator power supply (not shown). The latter applies a low-current high DC or pulsed voltage (typically 3 to 1,000 kV) of positive polarity to the base of each electrode 15. The consequent surface electric
5 field concentrated at the tip of each electrode results in corona discharges and the generation of positively charged particles (ions) in the fuel.

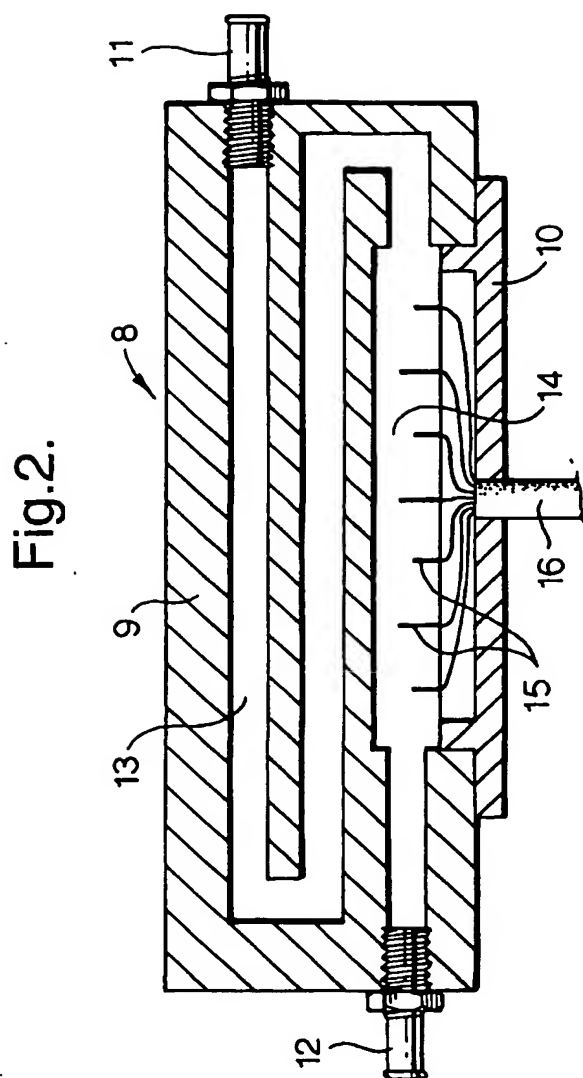
Although not all the effects of air and fuel ionisation in an apparatus as exemplified above are fully understood at present it is believed that applying charges of like
10 polarity to the fuel assists in the subsequent atomisation and dispersal of the fuel into finer droplets within the engine. Furthermore by charging the air for combustion at the opposite polarity to the fuel, subsequent intermixing of the fuel and air should be more rapid and more complete. The consequences are that combustion can be
initiated more reliably and the mixture can burn more completely, leading in turn to
15 better fuel economy, higher power output and reduction in the amounts of unburnt hydrocarbon, carbon monoxide, oxides of nitrogen and particle emissions.

CLAIMS

1. Apparatus for conditioning air and fuel supplied to a combustor, comprising:
a first chamber through which, in use, air flows to a combustor;
5 a second chamber through which, in use, fuel flows to a combustor;
first electrode means extending into the first chamber;
second electrode means extending into the second chamber; and
one or more electric power supplies adapted to be connected to said
electrode means whereby to generate ions of a first polarity in air flowing through the
10 first chamber and to generate ions of opposite polarity to said first polarity in fuel
flowing through the second chamber.
2. Apparatus according to claim 1 adapted to generate ions of negative polarity
in air flowing through the first chamber and to generate ions of positive polarity in fuel
15 flowing through the second chamber.
3. Apparatus according to claim 1 or claim 2 wherein the first electrode means
comprises one or more pointed members extending into the first chamber.
- 20 4. Apparatus according to any preceding claim wherein the second electrode
means comprises one or more pointed members extending into the second chamber.
5. A combustor equipped with apparatus according to any preceding claim for
conditioning air and fuel supplied to the same.
- 25 6. A combustor according to claim 5 being an internal combustion engine.
7. A method of conditioning air and fuel supplied to a combustor, comprising:
causing air to flow through a first chamber into which first electrode means
30 extend;
causing fuel to flow through a second chamber into which second electrode
means extend; and
applying electrical power to said electrode means whereby to generate ions of
a first polarity in air flowing through the first chamber and to generate ions of opposite
35 polarity to said first polarity in fuel flowing through the second chamber.

8. A method according to claim 7 wherein ions of negative polarity are generated in air flowing through the first chamber and ions of positive polarity are generated in fuel flowing through the second chamber.
- 5 9. A method according to claim 7 or claim 8 performed by means of apparatus according to claim 3 or 4.





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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F02M27/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 F02M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

PAJ, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 011, no. 111 (M-578), 8 April 1987 (1987-04-08) & JP 61 255257 A (HIDEYORI TAKAHASHI), 12 November 1986 (1986-11-12) abstract ---	1-9
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Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Raposo, J

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
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